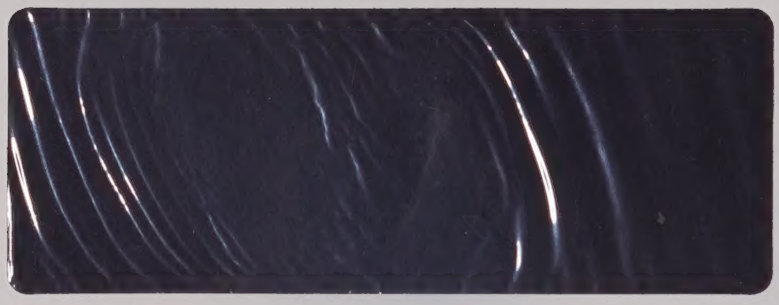
TEAC

AR-250SFM

SUPER FM AMPLIFIER UNIT

APPLICABLE MODELS : XR-5000/7000

TEAC CORPORATION



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INSTRUCTIONS
◆
SERVICE MANUAL

TEAC CORPORATION, JAPAN P/N 10111322-00

TEAC

AT-250SRM

INSTRUCTIONS

SERVICE MANUAL

TEAC CORPORATION, JAPAN

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1. GENERAL

The AR-250SFM is a wide band recording/reproducing FM amplifier unit independently developed by TEAC for the XR-5000/7000 cassette data recorder. It has two bands, SUPER BAND(*1) with a band width twice that of WBG-I and SUPER HIGH BAND(*2) with a band width four times that of WBG-I, thereby enabling recording/reproduction in a wider range of frequencies up to DC 80 kHz +0.5/-1.5 dB (76 cm/s for SUPER HIGH BAND).

*1 and *2: Named by TEAC

2. FEATURES

- A Butterworth low-pass filter enables recording/reproduction in bands (twice the band width of WBG-I for SUPER BAND and twice the width of the SUPER BAND, that is, four times the band width of WBG-I for SUPER HIGH BAND) with a flat frequency response characteristics.

- The AR-250SFM amplifier unit can easily be replaced by the XR-5000/7000 series standard FM amplifier unit.

- The AR-250SFM amplifier unit use the many functions of the XR-5000/7000 series data recorder in the same way as the standard FM amplifier unit.

1. GENERAL

The AR-2505FM is a wide band recording/reproducing FM amplifier unit independently developed by TEAC for the XR-5000/7000 cassette data recorder. It has two bands, SUPER BAND(*1) with a band width twice that of WBG-I and SUPER HIGH BAND(*2) with a band width four times that of WBG-I, thereby enabling recording/reproduction in a wider range of frequencies up to DC 80 kHz +0.5/-1.5 dB (76 cm/s for SUPER HIGH BAND).

*1 and *2: Named by TEAC

2. FEATURES

- A Butterworth low-pass filter enables recording/reproduction in bands (twice the band width of WBG-I for SUPER BAND and twice the width of the SUPER BAND, that is, four times the band width of WBG-I for SUPER HIGH BAND) with a flat frequency response characteristics.

- The AR-2505FM amplifier unit can easily be replaced by the XR-5000/7000 series standard FM amplifier unit.

- The AR-2505FM amplifier unit has the many functions of the XR-5000/7000 series data recorder in the same way as the standard FM amplifier unit.

3. CONFIGURATION

AR-250 SFM Super FM amplifier unit: 1 set

[Block diagram]

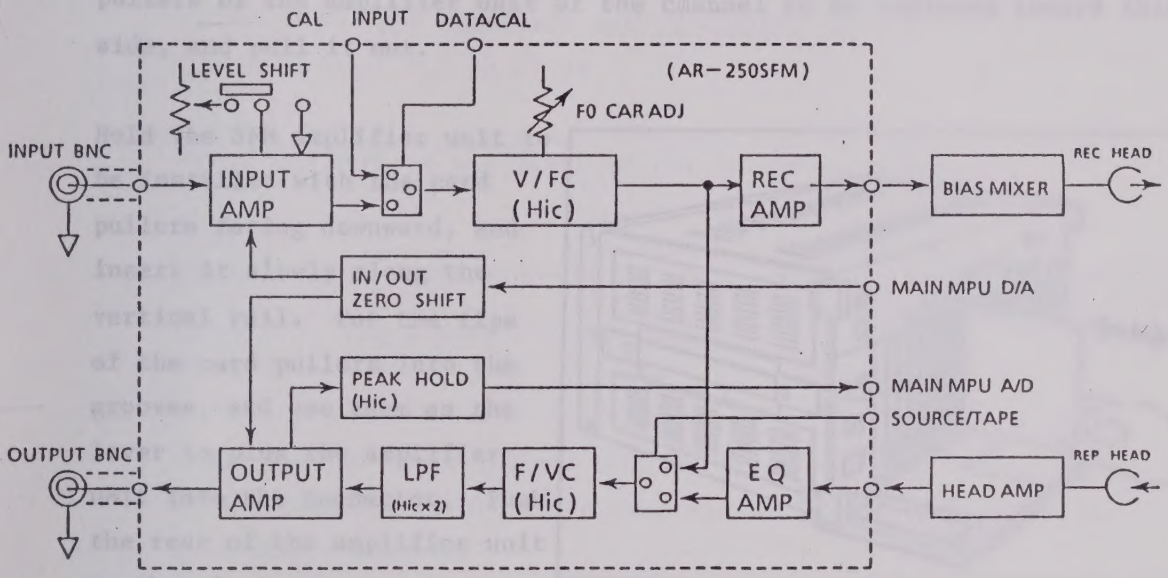


Fig. 3-1 Block diagram of the FM/SFM amplifier unit

3. CONFIGURATION

AR-250 SPM Super PM amplifier unit 1 set

[Block diagram]

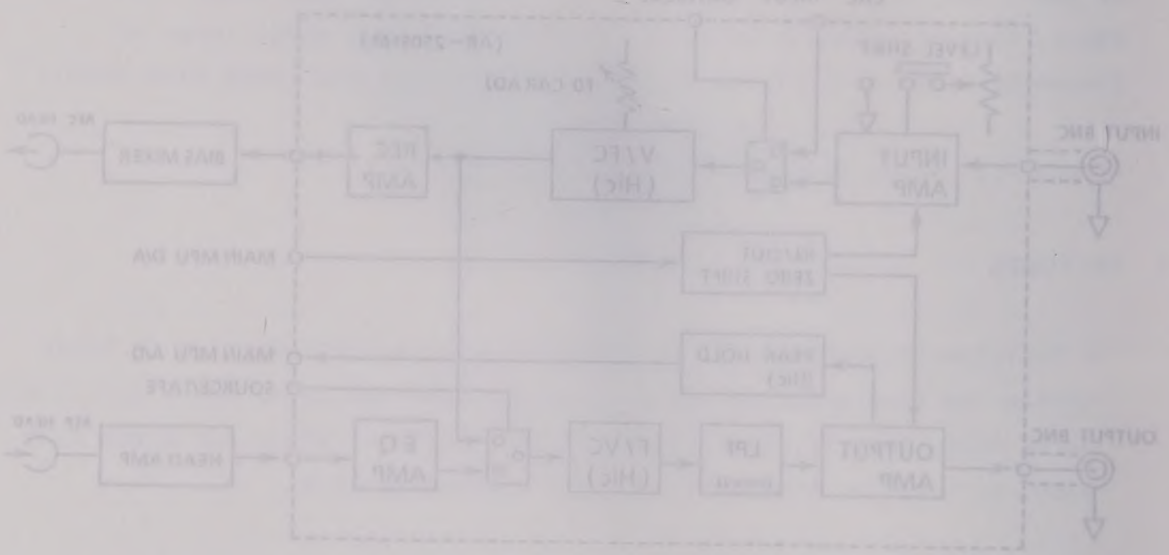


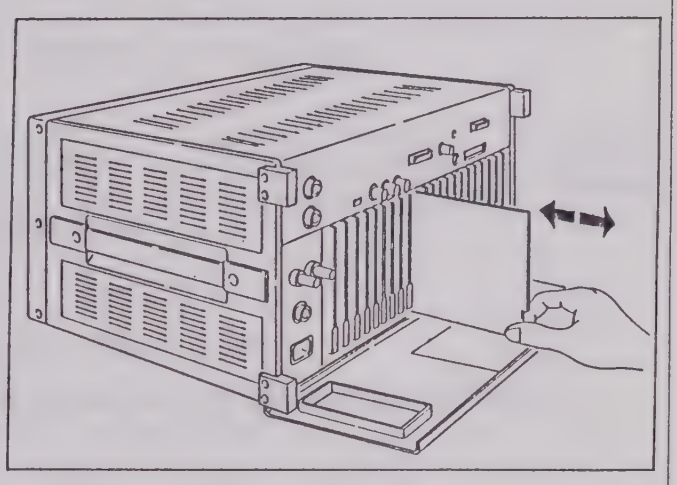
Fig. 3-1 Block diagram of the PM/SPM amplifier unit

4. HANDLING

4-1 Replacing the Amplifier unit

Confirm that the power switch is OFF. Raise the latches at the right and left of the rear panel, and open the panel. Then raise the card pullers of the amplifier unit of the channel to be replaced toward this side, and pull it out.

Hold the SFM amplifier unit to be installed with the card pullers facing downward, and insert it slowly along the vertical rail. Put the tips of the card pullers into the grooves, and use them as the lever to plug the amplifier unit into the connector. Push the rear of the amplifier unit so that it is completely plugged into the connector. See Picture 1.



Picture 1

4-2 Operation Check

Because the AR-250SFM amplifier unit has been adjusted, it can be used without any further adjustments. After replacement, check the following before using the AR-250SFM.

① Checking the PARAMETERS display

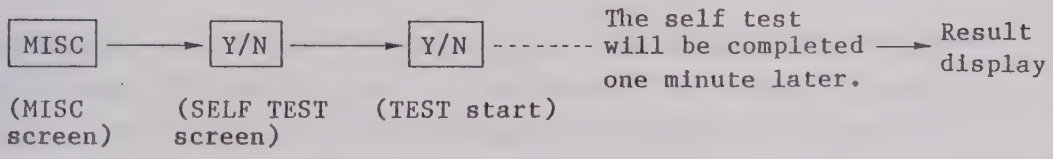
After power has been supplied, confirm that the channel whose amplifier unit was replaced on the initialization PARAMETERS screen changes from FM to SF (hereinafter called the SF-CH).

② Operation check by self-test

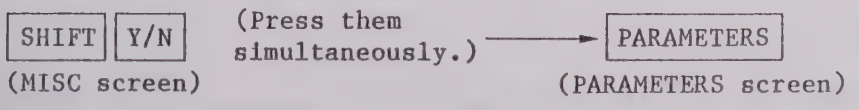
Load tape on which recording is permitted and set SYSTEM and PARAMETERS as follows:

ERASE:ON,FM BAND SELECT:HI BAND,SF-CH:REC ON
(Input range: 0.1 to 20 V)

Press the keys on the panel in the following order:



Check that SF-CH is changed to "CH□ SF OK".
After checking, return the screen to the initial screen by the following procedure:



4-3 Operation

The AR-250SFM amplifier unit can be handled in the same way as the standard FM amplifier unit. Refer to the instruction manual with the main unit for the details of recording/reproduction and other operations. To select a band, use the setting SYSTEM:FM BAND SELECT. Set WBG-1 for SUPER BAND and HIGH BAND for SUPER HIGH BAND.

5. NOTES

- Do not subject the unit to shock. When it is not in use, put it into the attached corrugated box for storage. A replaced FM amplifier unit must be handled in the same way as this unit.

- The maximum recording level for this unit is approximately ±140% full scale of the input range. If an excessive signal is input in Amp to Amp or REC/FWD mode, up to approximately ±140% only of the input range is indicated on the bar graph or monitor meter.

- The drift and noise level of this unit are a little greater than those of the standard FM amplifier unit. The standard FM amplifier unit, therefore, should be used for recording or reproduction of data for which wide dynamic range and high stability are required.

- Neither SUPER BAND nor SUPER HIGH BAND is compatible with other bands. Note that data recorded through the conventional data recorder or XR-5000/7000 standard FM amplifier unit cannot be reproduced by this unit.

- At COMP ON, do not install the SFM amplifier unit in the COMP channel (XR-5000: CH-14, XR-7000: CH-11). The noise compensation does not function normally for the FM amplifier unit.

6. SPECIFICATIONS (RATED PERFORMANCE WHEN XR-5000/7000 IS INSTALLED)

Recording/reproduction system:	FM recording/reproduction system SUPER BAND/SUPER HIGH BAND (named by TEAC)
Tape to be loaded:	EIAJ 12.7 mm wide VHS cassette tape (Maxell T-120HGX)
Input impedance:	100 kΩ (unbalanced)
Input voltage:	±0.1, 0.2, 0.3, 0.5, 0.7, 1, 1.4, 2, 3, 5, 7, 10, 14, and 20 Vp (14 steps) Auto range setting: ±0.3 to 20 Vp
Output impedance:	75 Ω (unbalanced)
Output voltage:	±0.1, 0.2, 0.5, 1, 1.4, 2, 3, and 5 Vp (8 steps) with 100 kΩ load
Output current:	20 mA min. (with 20 Ω load)
Input level shift:	±20 Vp (trimmer)
Input zero shift/ output zero shift):	±100% and 0.125% step (electronic switch)

Frequency characteristic and signal-to-noise ratio

Tape speed (cm/s)	SUPER HIGH BAND		SUPER BAND	
	Frequency characteristic (+0.5/-1.5 dB)	SN ratio	Frequency characteristic (+0.5/-1.5 dB)	SN ratio
76.2	DC ~ 80 KHz	39	DC ~ 40 KHz	43
38.1	DC ~ 40 KHz	39	DC ~ 20 KHz	43
19.05	DC ~ 20 KHz	39	DC ~ 10 KHz	43
9.52	DC ~ 10 KHz	37	DC ~ 5 KHz	41
4.76	DC ~ 5 KHz	35	DC ~ 2.5 KHz	39
2.38	DC ~ 2.5 KHz	33	DC ~ 1.25 KHz	37
1.19	DC ~ 1.25 KHz	30	DC ~ 0.625 KHz	31

Crosstalk:	Interchannel noise level or less
Linearity:	±0.5%
Drift:	±1.0% or less on one reel of tape after a 15-minute heat run
Ambient temperature and humidity:	0°C to 40°C, 20% to 80% (no condensation)

7. SCOPE

This section describes the adjusting specifications and standard values of XR-5000/7000 series super FM amplifier unit AR-250SFM.

8. OUTLINE OF THE AR-250SFM

The AR-250SFM super FM amplifier unit (hereafter called the SFM amplifier) has the same circuit configuration as the XR-5000/7000 standard FM amplifier unit (hereafter called the FM amplifier). See Fig. 3-1. Equivalent parts are used for HIC such as V/FC, F/VC, and PEAC HOLD. The circuit configuration of LPF HIC was slightly changed to achieve a cutoff frequency of up to 80 kHz and a zero shift with fewer speed changes.

The SFM amplifier differs from the FM amplifier in the following principal points:

- Center carrier, frequency deviation:
  See Table 1 and Figure 8-1.
- The cut-off frequency at each LPF code is doubled.
- Input impedance (SFM amplifier: 100 kΩ, FM amplifier: 1 MΩ)
- Input limiter level
  (SFM amplifier: approximately ±140% full scale,
  FM amplifier: approximately ±160% full scale)
- CH ID bus 1 (difference of amplifier type status: "1" for the SFM amplifier and "0" for FM amplifier)

Table 1 FM recording parameters for each XR-5000/7000 band
(tape speed: 76 cm/s)

Band	Center carrier frequency	Deviation frequency (+) (+100% full scale input)	Deviation frequency (-) (-100% full scale input)	Modulation frequency band width
WIDE BAND G-I	108 kHz	151.2 kHz	64.8 kHz	DC-20 kHz (+0.5/-1.0 dB)
HIGH BAND	216 kHz	302.4 kHz	129.6 kHz	DC-40 kHz (+0.5/-1.0 dB)
SUPER BAND (named by TEAC)	129.6 kHz	162.0 kHz	97.2 kHz	DC-40 kHz (+0.5/-1.5 dB)
SUPER HIGH BAND (named by TEAC)	259.2 kHz	324.0 kHz	194.4 kHz	DC-80 kHz (+0.5/-1.5 dB)

Table 2 FM recording parameters for SUPER BAND
and SUPER HIGH BAND

Tape speed (cm/s)		FM carrier DEV. (kHz)			BW +0.5/-1.5 dB (kHz)
SUPER BAND	SUPER HIGH BAND	-25%	0%	+25%	
———	76.2	194.4	259.2	324.0	80
76.2	38.1	97.2	129.6	162.0	40
38.1	19.05	48.6	64.8	81.0	20
19.05	9.52	24.3	32.4	40.5	10
9.52	4.76	12.15	16.2	20.25	5
4.76	2.38	6.075	8.1	10.125	2.5
2.38	1.19	3.0375	4.05	5.0625	1.25
1.19	———	1.51875	2.025	2.53125	0.625

9. ADJUSTMENTS

9-1 Jigs and Instruments to be Used for Adjustments and Function Checks

- Extender (amplifier) Part No. 15552648
- VHS cassette tape T-120 (Maxell T-120HGX)
- Digital voltmeter (DC voltmeter)
- Standard voltage generator (0 to ±5 V)
- Frequency counter
- Oscilloscope or AC meter
- Oscillator (8 kHz 4 Vp-p, used for function check)

9-2 Preparation for Adjustments

1) Standard PCBA such as the MAIN MPU, BIAS MIXER, and CAL/MEMO must be adjusted before operation.
2) A heat run of at least 30 minutes is required.
3) Unless otherwise specified, the main unit system functions and parameters must be set as follows:

[SYSTEM]

1. TAPE SERVO CH :DATA
2. CH13 MEMO READ :OFF
4. ERASE :ON
5. FM BAND SELECT :HI BAND
8. PRESET INITIALIZE :0

[PARAMETERS]

- INPUT RANGE :1.0 V
- INPUT ZERO SHIFT :0%
- OUTPUT LEVEL :1.0 V
- OUTPUT ZERO SHIFT :0%
- FILTER :FA

[TAPE SPEED] :9.5 cm/s

- CAL, ID, MISC :All OFF

Initialization

Set 8. PRESET INITIALIZE:0 for [SYSTEM] and turn POWER ON, and the initialized states at the left are given.

- MONITOR CH :Set to the adjusted PCBA installed channel after initialization.

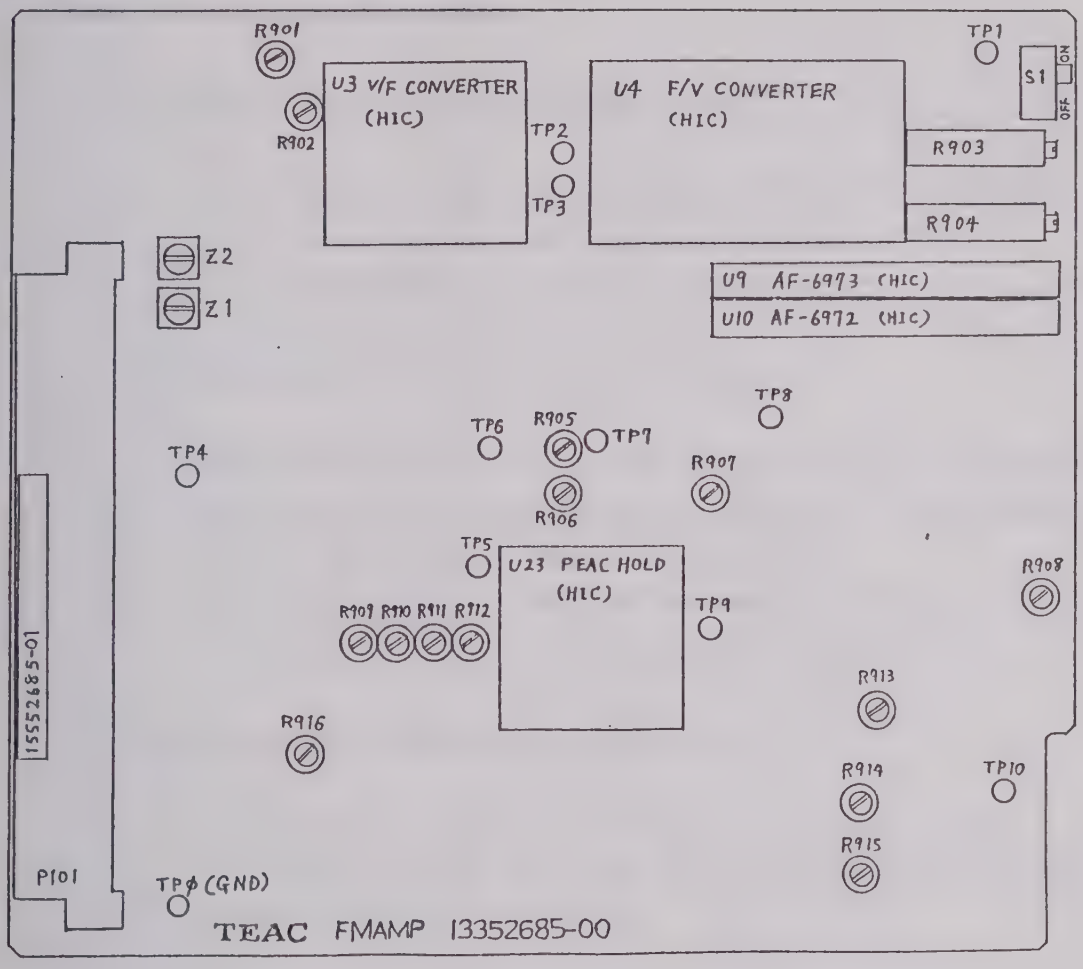
4) Turn DIP SW 2-2(*1) and DIP SW 2-3(*2) on the MAIN MPU PCBA from OFF to ON. Turn the power switch off and extract the MAIN MPU PCBA from the main unit, then make the above adjustment. After adjustment, restore the original setting.

(*1) Turning on DIP SW 2-2 of the MAIN MPU changes the functions as shown below:

CAL execution key	Details of function change (DIP SW 2-2 on the MAIN MPU is turned on)
DC +100%	CAL OFF, INPUT ZERO SHIFT +100%, OUTPUT ZERO SHIFT -100%
0%	CAL OFF, INPUT/OUTPUT ZERO SHIFT 0%
Other than above	CAL OFF, INPUT ZERO SHIFT -100%, OUTPUT ZERO SHIFT +100%

(*2) The V/F monitor output is selected for the MONITOR OUT BNC output when DIP SW 2-3 on the MAIN MPU is turned on. The V/F monitor in the text means the V/F monitor output value read with the frequency counter. The output level is constant as 129.6 kHz at 0 V input, regardless of the tape speed.

9-3 Location of AR-250SFM PCBA



9-4 Adjustment Procedure

The AR-250 SFM amplifier unit is adjusted with an extender (amplifier). No specific channel is designated, but do not use COMP CH or EDGE CH. (XR-5000: Channel 1, 2, or 14, XR-7000: Channel 1, 2, 11, or 21)

Before adjusting, connect a standard voltage generator to INPUT BNC and a frequency counter to MONITOR OUT BNC. Use a digital voltmeter to measure voltage. TP-0 must be used as grounding during adjustments.

9-4-1 Adjusting the recording amplifier

1) Adjusting the input amplifier offset

Adjust R909 so that the voltage at TP-4 is 0 V ±1 mV when the input range is 0.1 V and the input voltage is 0 V.
Then, adjust R910 so that the voltage at TP-5 is 0 V ±1 mV.

2) Adjusting the input zero shift offset

Adjust R915 so that the voltage at TP-10 is 0 V ±2 mV when the input zero shift is 0% (press the CAL0 key). INPUT/OUTPUT ZERO SHIFT = 0% is called "CAL0" hereinafter.
Then, adjust R911 so that the voltage at TP-6 is 0 V ±1 mV when the input range is 1 V and the input voltage is 0 V.

3) Adjusting the input zero shift gain

Set the input voltage to −1 V and the input zero-shift to +100% by pressing the CAL DC + 100% key, and adjust R912 so that the voltage at TP-6 is 0 V ±1 mV.

4) Adjusting the V/F converter center carrier

a. Set the input range to 1 V, the tape speed to 76 cm/s, and R904 to the approximate midpoint (15 turns counterclockwise, and 8 turns clockwise).
b. Adjust R902 so that the V/F monitor(*3) is 129.6 kHz ±200 Hz when the input voltage is 0 V and "CAL0" is set.

(*3) See Section 9-2 4).

c. Adjust R904 so that the V/F monitor is 129.6 kHz ±20 Hz.

5) Adjusting the deviation

Adjust R901 so that the V/F monitor is 162.0 kHz ±50 Hz when the input voltage is +1.0 V and "CAL0" is set. Then, set the input voltage to -1.0 V, and confirm that V/F monitor is within 97.2 kHz ±100 Hz.

* If the V/F monitor exceeds the specified value, repeat adjustments from item c in 4).

9-4-2 Adjusting the reproducing amplifier

1) Adjusting the low-pass filter output zero point

Set R905, R906, R909, and R916 to approximate midpoint.
When the input voltage is 0 V and "CAL0" is set, measure the voltage at two points where tape speed is 9.5 and 4.8 cm/s, and adjust R916 so that absolute values of two voltages are almost equal ($\left|V_{9.5\ cm/s}\right| = \left|V_{4.8\ cm/s}\right|$).
Then, adjust the input voltage so that the V/F monitor is 129.6 kHz ±20 Hz when the tape speed is 38 cm/s. At this time, adjust R906 so that the voltage at TP-7 is 0 V ±1 mV.
Then, set the tape speed to 2.4 cm/s, and adjust R905 so that the voltage at TP-7 is 0 V ±1 mV.

2) Adjusting the low-pass filter output gain

Adjust the input voltage so that the V/F monitor is 162 kHz ±20 Hz when the tape speed is 2.4 cm/s.
Input voltage: Approximately +1 V.
At this time, adjust R907 so that the voltage at TP-7 is -1 V ±2 mV.

3) Adjusting the output zero shift offset

Adjust the input voltage so that voltage at TP-7 is 0 ±1 mV. Then, set "CAL0" (output zero shift = 0%), and adjust R914 so that the voltage at TP8 is 0 V ±2 mV.

4) Adjusting the output zero shift gain

Press the CAL DC +100% key and adjust the input voltage so that the V/F monitor is 162 kHz ±20 Hz. At this time, adjust R913 so that the voltage at TP-8 is 0 ±2 mV.

5) Adjusting the output amplifier offset

Press the CAL0 key and adjust the input voltage so that the voltage at TP-8 is 0 ±1 mV. At this time, adjust R908 so that the voltage at TP-9 is 0 ±1 mV.
After adjustments up to 5) above, turn off the MAIN MPU DIP SW 2-2 and DIP SW 2-3.

9-4-3 Adjusting the erase trap

(1) Adjustment procedure 1 (adjustment with an oscilloscope)

a. Set the tape speed to 76 cm/s, the band to WBGI, the erase function to on, and the CH REC function to off.
b. Insert a tape on which data can be recorded, and set it to REC/FWD mode. At this time, observe the oscilloscope to adjust Z2, so that the 800-kHz erase signal at TP-1 is minimum.
c. When adjustment is complete, fix Z1 and Z2 with locking paint.

* Set the range of the oscilloscope to 10 mV/div and 1 to 2 μs/div. To adjust the trigger apply an erase signal from TP24-GP24, the bias mixer PCBA erase current adjustment terminal.

(2) Adjustment procedure 2 (adjustment with an AC meter)

a. Mount the SFM amplifier unit in channels 5 to 7 with an extender.
b. Set the tape speed to 76 cm/s, the band to WBGI, the erase function to on, and the CH REC function to off.
c. Insert a tape on which data can be recorded, and set it to REC/FWD mode. At this time, observe the AC meter to adjust Z2 so that noise level at TP-1 is minimum.
d. When the adjustment is complete, fix Z1 and Z2 with locking paint.

* Set the range of the AC meter to -40 to -50 dBm (0.01 to 0.003 V). Use Alligator BNC cable or a probe (x1) for connection.

10. SFM AMPLIFIER SPECIFICATIONS

NOTE: MAIN MPU DIP SW2-2, 3 ON

Item	Manufacture standard	Inspection standard	Check point	Measuring condition
Input amplifier record standard point offset (1)	0 ±10 mV	0 ±15 mV	TP6	INPUT RANGE = 0.1 V INPUT ZERO SHIFT = 0% (CALO KEY = ON) INPUT = 0 V
Input amplifier record standard point offset (2)	0 ±3 mV	0 ±5 mV	TP6	INPUT RANGE = 1.0 V INPUT ZERO SHIFT = 0% (CALO KEY = ON) INPUT = 0 V
Input amplifier ATT gain	+1 V ±20 mV	+1 V ±20 mV	TP6	INPUT RANGE = 1.0 V INPUT = -1.0 V
Input zero shift gain	0 ±3 mV	0 ±5 mV	TP6	INPUT RANGE = 1.0 V INPUT ZERO SHIFT = +100% (CAL+100% KEY = ON) INPUT = -1.0 V
V/F converter center frequency	129.6 kHz ±300 Hz	129.6 kHz ±600 Hz	MONITOR OUT BNC	INPUT RANGE = 1.0 V INPUT = 0 V Tape speed = 76 cm/s, SUPER HIGH BAND
Percentage modulation	64.8 kHz ±600 Hz	64.8 kHz ±600 Hz	MOMITOR OUT BNC	INPUT RANGE = 1.0 V Obtain $f_+ - f_-$ from INPUT = ±1.0 V.
Reproduction standard point zero	0 ±15 mV	0 ±15 mV	TP7	INPUT RANGE = 1.0 V Adjust the input voltage so that the V/F monitor frequency is 129.6 kHz ±20 Hz. 76 cm/s-1.2 cm/s, SUPER HIGH BAND
Reproduction standard point gain	-1 V ±20 mV	-1 V ±20 mV	TP7	INPUT RANGE = 1.0 V Adjust the input voltage so that the V/F monitor frequency is 162.0 KHz ±20 Hz. Tape speed = 2.4 cm/s, SUPER HIGH BAND

Item	Manufacture standard	Inspection standard	Check point	Measuring condition
Output zero point	0 ±15 mV	0 ±15 mV	OUTPUT BNC	INPUT/OUTPUT RANGE = 1.0 V V/F monitor: 129.6 kHz ±20 Hz, 2.4 cm/s
Output gain	+1 V ±20 mV	+1 V ±20 mV	OUTPUT BNC	INPUT/OUT RANGE = 1.0 V V/F monitor: 162.0 kHz ±20 Hz, 2.4 cm/s
Output zero shift gain	0 ±20 mV	0 ±20 mV	OUTPUT BNC	INPUT/OUT RANGE = 1.0 V Set CAL +100% KEY to ON. Adjust the input voltage (approximately 0 V) so that the V/F monitor frequency is 162.0 kHz ±20 Hz.

11. SFM AMPLIFIER PCBA FUNCTION CHECK

* Operations for one item must be performed in sequence.

Item	Operation	Check item
0. Preparation		
0-1	Set MAIN MPU PCBA as follows: DIP SW2 — XR-5000: Turns all SWs off. XR-7000: Turns all the SWs off except 7 and 8. JP1 ——— Side 1	Power must be off.
0-2	Turn the power switch on, and press the reset SW of MAIN MPU PCBA.	
0-3	Set FUNCTION [SYSTEM] as follows: 1. TAPE SERVO CH :DATA/COMP/TS 2. CH13 MEMO READ :OFF/ON 3. INHIBIT ON REC :OFF/ON 4. ERASE :OFF/ON 5. FM BAND SELECT :WB/HI BAND 6. ID CODE FORMAT :510/5000 7. REVERSE RECORD :OFF/ON 8. PRESET INITIALIZE :0/1 9. POWER FAIL RESTART :0/1 10. POWER SW OFF MODE :0/1/2 11. CAL SW MODE :0/1 12. TAPE REMAIN :%/MIN 13. BEEP TONE :OFF/ON	This parameter is CH22 MEMO UNDEFINED in XR-7000 Press [Y/N] to end setting.
1. Initial setting display	POWER SW OFF → ON Note: To simplify setting parameters, the setting is changed for all channels simultaneously. However, the signal input channel indicates the SFM amplifier mounting channel, and check items indicate those for the SFM amplifier mounting channel unless otherwise specified.	Checking EL DISPLAY PARAMETER display SPEED ——— 9.5 cm/s COUNTER ——— 0000 REMAIN ——— ***% MONITOR CH ——— 1 MONITOR MODE ——— SOURCE MONITOR METER ——— DC Amplifier type AR-250FM mounting channel ——— FM AR-250SFM mounting channel ——— SF INPUT RANGE — All channels — 1.0 INPUT ZERO — All channels — +000% OUTPUT LEVEL — All channels — 1.0 FILTER ——— All channels — FA REC ——— All channels — ON
2. Amplifier	* Perform 2-1 to 2-5 in series.	
2-1 REC SIG OFF check	- Set tape speed to 9.5 cm/s and CAL to [0%]. Press [DISPLAY] key and perform REC/FWD operation from counter value 0000 to 0020. Then press the [STOP] key. - Restore the counter to 0000 in Fast Reverse mode, then press the [STOP] key. Set CAL to [AC 100%], and reproduce data by pressing the [FWD] key until the counter value is 0010, then press the [STOP] key.	(H. BAND LED is off. —— SUPER BAND) The bar graph indicates 0% for all channels during REC/FWD operation. The bar graph for all channels indicates 0% during FWD operation. It indicates ±100% during STOP.

Item	Operation	Check item
2-2 CH REC OFF	- Set CAL to [AC 100%], and press the [PARAMETERS] and [Y/N] keys. Then hold down the [SHIFT] and [▲] keys simultaneously, and when INPUT RANGE for channel 1 goes off, set REC to off for all channels by pressing the [SHIFT] and [▶] keys simultaneously. Press the [SHIFT] and [Y/N] keys simultaneously, then press the [DISPLAY] key.	The bar graph indicates 0% for all channels.
2-3 Carrier detector	- Set CAL to [AC 100%]. Press the [SYSTEM] key, and select HIGH BAND for parameter 5, FM BAND SELECT, then press the [Y/N] key. Perform REC/FWD operation from counter value 0010 to 0020. Then press the TAPE SPEED [DOWN] key at intervals of 10 seconds to decrease tape speed from 4.8 cm/s to 2.4 cm/s, then to 1.2 cm/s. Then, press the [STOP] key.	The H. BAND LED goes on. SUPER HIGH BAND is set for the SFM amplifier. The bar graph indicates 0% for all channels during REC/FWD operation.
2-4 Input inhibit	- Operate the recorder in REV mode at a tape speed of 1.2 cm/s and perform reproduction in REV mode for 10 seconds, and press the [STOP] key.	The bar graph indicates 0% for all channels.
2-5 REC reference	- Set the tape speed to 4.8 cm/s and the input range to 1.0 V for all channels. Press the [DISPLAY] key and operate the recorder in REV mode for 10 seconds, and press the [STOP] key.	The bar graph indicates ±100% for all channels during REV.
2-6 Limiter	- Set the input range to 1.0 V and the tape speed to 76 cm/s, then turn CAL off. Select SUPER HIGH BAND and input 8-kHz 4 Vp-p sine wave into the SFM channel, then perform the REC/FWD operation.	Observe output from OUTPUT BNC on an oscilloscope, and confirm that waveform is clipped at ±1.3 V to ±1.5 V and that no waveform is missing.
3. Auto range	- Set the input range to 1.0 V, and input +4.5 V into SFM channel. Move the cursor to AT RNG (auto range) on PARAMETERS screen, then press the [Y/N] key. - Press the [SHIFT] and [▲] keys simultaneously, the [SHIFT] and [▶] keys simultaneously, then the [Y/N] key. - Press the [Y/N] key 5 seconds later. - Press the [Y/N] key, then the [SHIFT] and [Y/N] keys simultaneously.	The screen changes to the AUTO RANGE screen. The all channel ON display appears, and the characters "AUTO RANGE" starts blinking. Blinking stops and the new range is set to 5.0 V. The screen changes to the PARAMETERS screen. (Input range = 5.0 V)
4. Input auto zero	* Perform items 4 to 6 in series. - Set CAL to [DC +100%], move the cursor to AT ZR [I].0 (auto zero input) on the PARAMETERS screen, and press the [Y/N] key. - Press the [SHIFT] and [▲] keys simultaneously, the [SHIFT] and [▶] keys simultaneously, then the [Y/N] key. - Press the [SHIFT] and [Y/N] keys simultaneously.	The screen changes to the AUTO ZERO <INPUT> screen. The all channels ON display appears, and the characters "AUTO ZERO" start blinking. They go on 8 seconds later. The resulting display indicates -100% ±5%. The screen changes to the PARAMETERS screen.

Item	Operation	Check item
5. Output auto zero	- Press CAL [DC +100%], move the cursor to AT ZR I.[0] (auto zero input) on the PARAMETERS screen, then press the [Y/N] key. - Press the [SHIFT] and [▲] keys simultaneously, [SHIFT] and [▶] keys simultaneously, then the [Y/N] key. - Press the [SHIFT] and [Y/N] keys simultaneously.	The screen changes to AUTO ZERO OUTPUT screen. The all channels ON display appears, and the characters "AUTO ZERO" start blinking. They go on 8 seconds later. The resulting display indicates -100% ±5%. The screen changes to the PARAMETERS screen.
6. Monitor (Input zero shift) (Output zero shift)	- The set CAL to [0%] and the monitor channel to the measured channel (SFM CH) by pressing the MONITOR [CH▼] key. - Press the MONITOR [MODE] key. - POWER SW OFF → ON	Monitor meter display SOURCE DC is set to approximately -100% ±5%. OUTPUT DC is set to approximately -2.00 V + 0.1 V The screen returns to the PARAMETERS initial setting screen.
7. Self test	- Load a tape on which data can be recorded and press the [MISK] key. - Confirm that the cursor is positioned at SELF TEST, and press the [Y/N] key. - Press the [Y/N] key. Measured channel REC ON ERASE ON BAND SELECT HI BAND - Perform the test at the above setting. - After the self test is completed, press the [SHIFT] and [Y/N] keys simultaneously to set the MISK screen.	The screen changes to the MISK screen. The screen changes to the SELF TEST screen. The characters "SELF TEST" start blinking. 10 seconds later, the REC/FWD, REC/REV, and REV operations are performed in that order. The counter returns to original position after a total delay of 65 seconds. The test is completed, and the result is displayed. 1. POWER UNIT: OK 2. AMP: SFM amplifier mounted channel 3. ERASE: FWD OK, REV NG 4. HEAD: OK Confirm that the result is indicated as shown above.

12. AR-250SFM GENERAL SPECIFICATION TABLE

This specification table applies to the unit for which all the adjustments have been completed.

Measuring condition

Power:	100 V AC ±10% or 12 V DC ±5%
Tape to be used:	VHS cassette tape T-120 (MAXELL T-120HGX)

The system functions and parameters of the XR-5000/7000 main units are set as follows unless otherwise specified:

[SYSTEM]

TAPE SERVO CH	:DATA
CH13 MEMO READ	:OFF (XR-7000: CH22 MEMO UNDEFINED)
ERASE	:ON
FM BAND SELECT	:HI BAND (SUPER HIGH BAND)

[PARAMETERS]

INPUT RANGE = 1.0 V	
INPUT ZERO SHIFT = 0%	
OUTPUT LEVEL = 1.0 V	
OUTPUT ZERO SHIFT = 0 %	
FILTER	:FA (Flat amplitude)
LEVEL SHIFT	:OFF
CAL	:OFF

Item	Manufacture standard	Inspection standard	Catalog value	Check point	Measuring condition
Input impedance	100 kΩ ±10%	100 kΩ ±10%	100 kΩ	INPUT BNC	Resistor replacement method or digital voltmeter
Output impedance	75 Ω ±10%	75 Ω ±10%	75 Ω	OUTPUT BNC	Resistor replacement method or digital voltmeter
Input range accuracy	Each range ±3%	Each range ±3%		OUTPUT BNC	Measure where the OUTPUT RANGE is 1.0 V.
Center frequency	129.6 kHz ±300 Hz	129.6 kHz ±600 Hz		TP1	INPUT BNC = 0 V 38 cm/s, SUPER HIGH BAND
Percentage modulation	64.8 kHz ±600 Hz	64.8 kHz ±600 Hz		TP1	INPUT BNC = ±1 V Percentage modulation = $f_+ - f_-$
Input zero shift	+100% to ±120%	+100% to ±120%	±100%	Bar graph	When the INPUT BNC is set to 0 V, and the INPUT ZERO SHIFT is set to +110%, the bar graph must indicate ±100% to ±120%.
Input level shift	+100% to ±120%	+100% to ±120%	±20 V	Bar graph	INPUT BNC = 0 V Set the INPUT BNC to 0 V, the INPUT RANGE to 20 V, and the level shift switch to ON. Turn R903 fully clockwise and counterclockwise.
Output range accuracy	Each range ±3%	Each range ±3%		OUTPUT BNC	Set the INPUT RANGE to 1.0 V, apply +1 V and 0 V to INPUT BNC, and measure.
Output current	+20 to ±40 mA	-20 to ±40 mA	20 mA	OUTPUT BNC	Measure with OUTPUT RANGE = 5 V, the INPUT BNC = ±1 V, and load resistance = 20 Ω.
Output zero shift	±1.4 to ±1.6 V	±1.4 to ±1.6 V	±100%	MONITOR METER (DVM)	INPUT BNC = 0 V, OUTPUT ZERO SHIFT = +MAX Monitor mode: OUTPUT DC

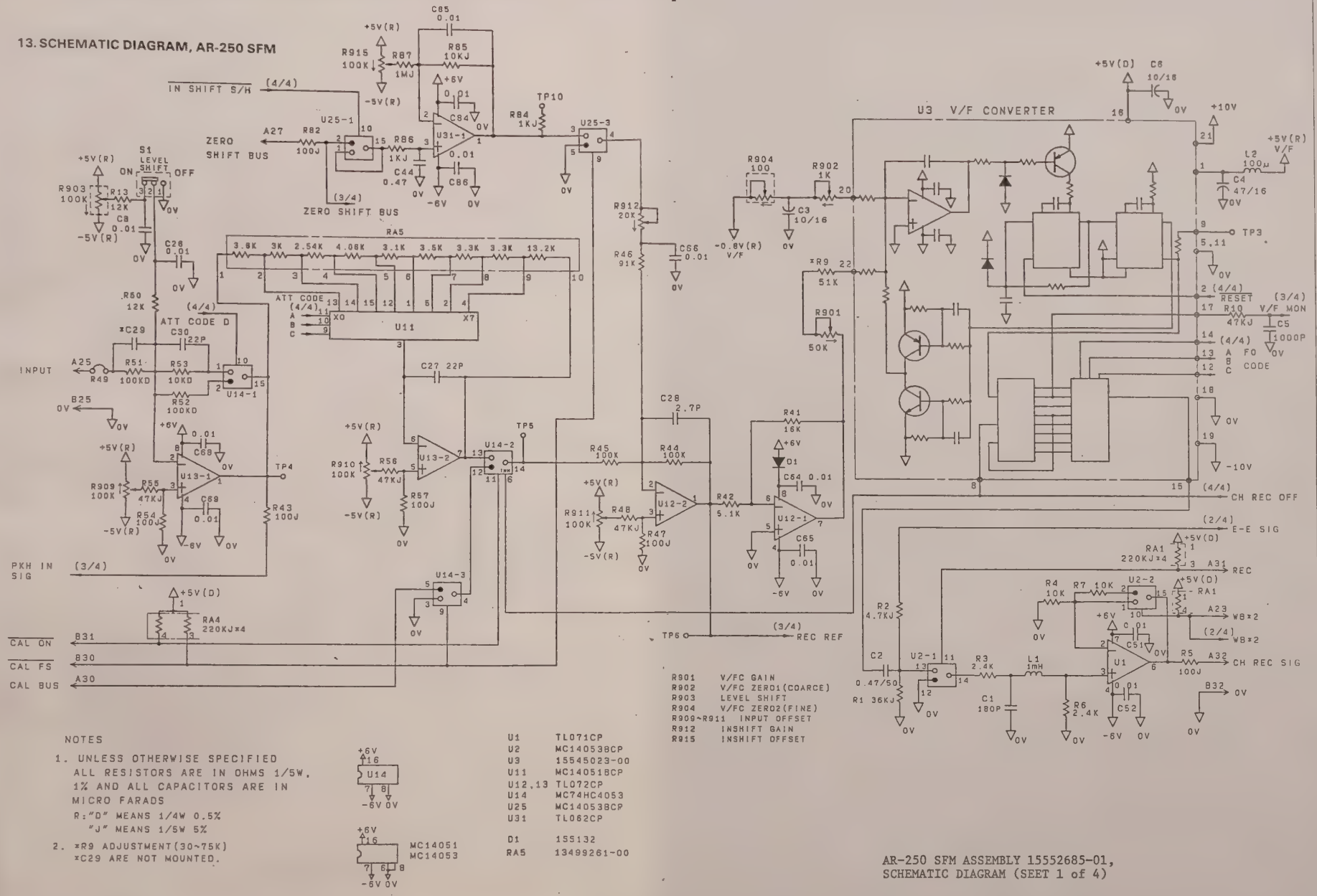
Item	Manufacture standard	Inspection standard	Catalog value	Check point	Measuring condition
Linearity	Each speed -0.4%	Each speed ±0.45%	0.5 % or less	OUTPUT BNC	SUPER HIGH BAND INPUT BNC = ±1 V (All speeds) Measure only SUPER BAND and 1.2 cm/s.
Frequency characteristics (SUPER HIGH BAND) 76 cm/s DC-80 kHz 38 cm/s DC-40 kHz 19 cm/s DC-20 kHz 9.5 cm/s DC-10 kHz 4.8 cm/s DC-5 kHz 2.4 cm/s DC-2.5 kHz 1.2 cm/s DC-1.25 kHz (SUPER BAND) 1.2 cm/s DC-625 Hz	AMP +0.4/-1.2 dB PHS +0.4/ -9 ±3 dB (at fc)	AMP +0.5/-1.5 dB PHS +0.5/ -9 ±3 dB (at fc)	AMP +0.5/ -1.5 dB	OUTPUT BNC	INPUT RANGE = 1.0 V OUTPUT RANGE = 1.0 V SUPER HIGH BAND: All speeds Measure SUPER BAND only at 1.2 cm/s. When a 2 Vp-p sine wave is input, the standard is AMP to AMP 1/10 fc (0 dB).
Square wave response	The overshoot fluctuation must not exceed 2% peak-to-peak (40 mV).	The overshoot fluctuation must not exceed 2% peak-to-peak (40 mV).		OUTPUT BNC	76 cm/s SUPER HIGH BAND Input a 8 kHz ±1 Vp square wave and measure in simultaneous recording and reproduction mode.

Item	Manufac-ture standard	Inspection standard	Catalog value	Check point	Measuring condition
S/N rate SUPER HIGH BAND 76 cm/s 38 cm/s 19 cm/s 9.5 cm/s 4.8 cm/s 2.4 cm/s 1.2 cm/s	COMP ON/OFF 39 dB 39 dB 39 dB 37 dB 35 dB 33 dB 30 dB	COMP ON/OFF 39 dB 39 dB 39 dB 37 dB 35 dB 33 dB 30 dB	 39 dB 39 dB 39 dB 37 dB 35 dB 33 dB 30 dB	OUTPUT BNC	INPUT BNC = 0 V INPUT RANGE = 1.0 V OUTPUT RANGE = 1.0 V SUPER HIGH BAND A11 speeds COMP ON/OFF * COMP CH must be AR-250FM HIGH BAND.
S/N rate SUPER BAND 76 cm/s 38 cm/s 19 cm/s 9.5 cm/s 4.8 cm/s 2.4 cm/s 1.2 cm/s	COMP ON/OFF 43 dB 43 dB 43 dB 41 dB 39 dB 37 dB 31 dB	COMP ON/OFF 43 dB 43 dB 43 dB 41 dB 39 dB 37 dB 31 dB	 43 dB 43 dB 43 dB 41 dB 39 dB 37 dB 31 dB	OUTPUT BNC	INPUT BNC = 0 V INPUT RANGE = 1.0 V OUTPUT RANGE = 1.0 V SUPER BAND A11 speeds COMP ON/OFF * COMP CH must be AR-250FM WBGI.
Cross talk	Same as for S/N	Same as for S/N	Noise level or less	OUTPUT BNC	SUPER HIGH BAND 76 cm/s, 38 cm/s, 19 cm/s Input fc for each speed to the channels other than measured channel. Set 0 V for the input BNC of the measured channel.
Level conversion character-istics	±10 mV or less	±15 mV or less		OUTPUT BNC	Record at 76 cm/s tape speed and 0 V input in the SUPER HIGH BAND, then perform reproduc-tion at 9.5 cm/s or 1.2 cm/s tape speed.

Item	Manufacture standard	Inspection standard	Catalog value	Check point	Measuring condition
Drift	±0.8% or less	±1.0% or less	±1.0%	OUTPUT BNC	Perform REC/FWD operation at 2.4 cm/s immediately after power is turned on. Rewind a reel of tape, and reproduce it at a tape speed of 76 cm/s. During recording, use the chart recorder for checking measurement stability in both recording and reproduction modes. Measure drift from 15 minutes after power was turned on until the signal stabilizes.
Temperature test	No notable abnormality must be detected in operation, drift or dropout.				0°C, 40°C
Dropout				OUTPUT BNC	SUPER HIGH BAND 76 cm/s, 1.2 cm/s Perform simultaneous recording/reproduction when +1 V is applied to INPUT BNC.
Tape servo S/N					

* fc is the maximum band frequency of the frequency characteristic for each speed in the individual BAND (cutoff frequency).

13. SCHEMATIC DIAGRAM, AR-250 SFM

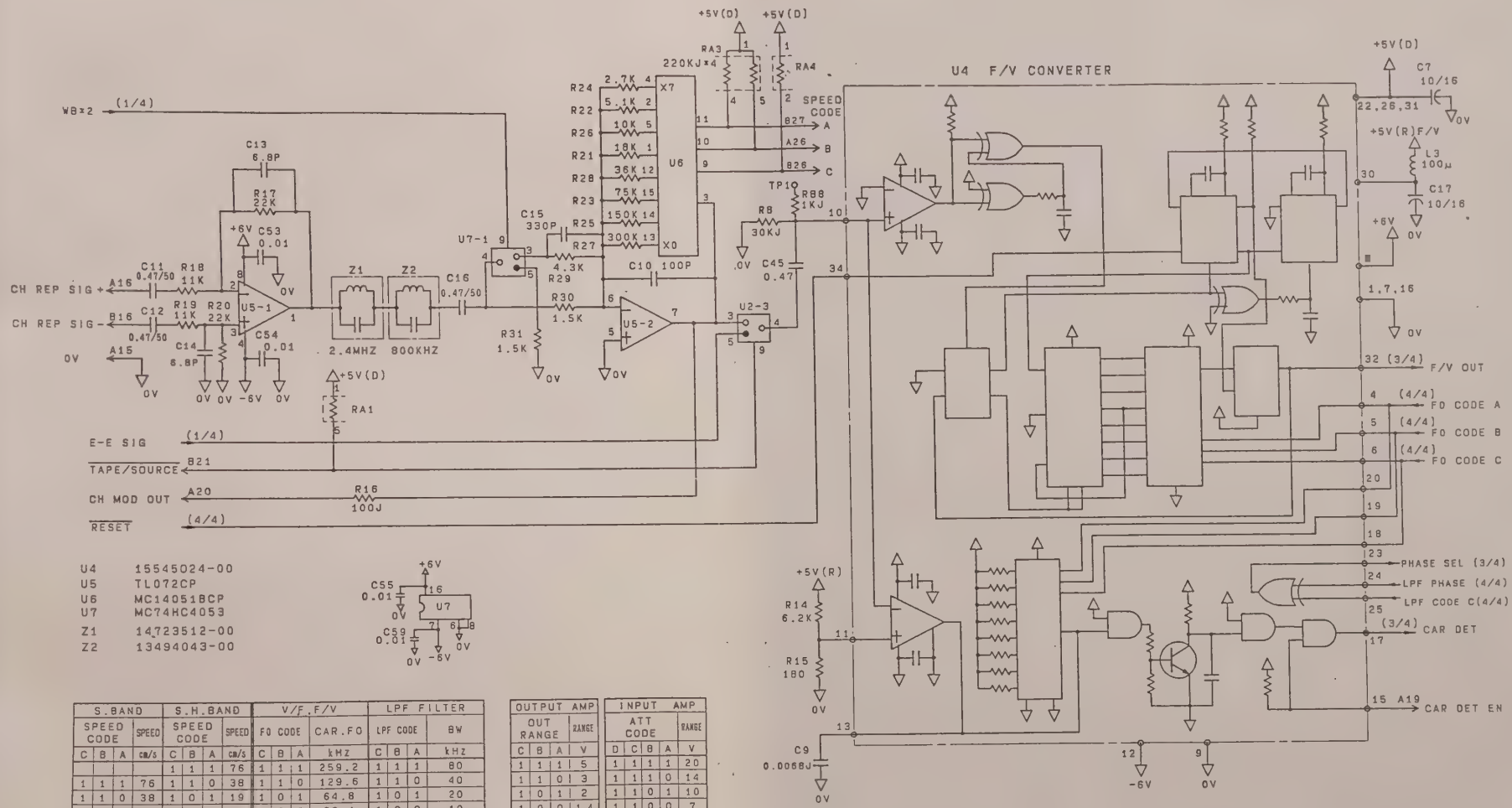


NOTES

1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHMS 1/5W, 1% AND ALL CAPACITORS ARE IN MICRO FARADS
   R:"D" MEANS 1/4W 0.5%
   "J" MEANS 1/5W 5%
2. *R9 ADJUSTMENT(30~75K) *C29 ARE NOT MOUNTED.

U1	TL071CP
U2	MC14053BCP
U3	15545023-00
U11	MC14051BCP
U12,13	TL072CP
U14	MC74HC4053
U25	MC14053BCP
U31	TL062CP
D1	1SS132
RA5	13499261-00

AR-250 SFM ASSEMBLY 15552685-01,
SCHEMATIC DIAGRAM (SEET 1 of 4)



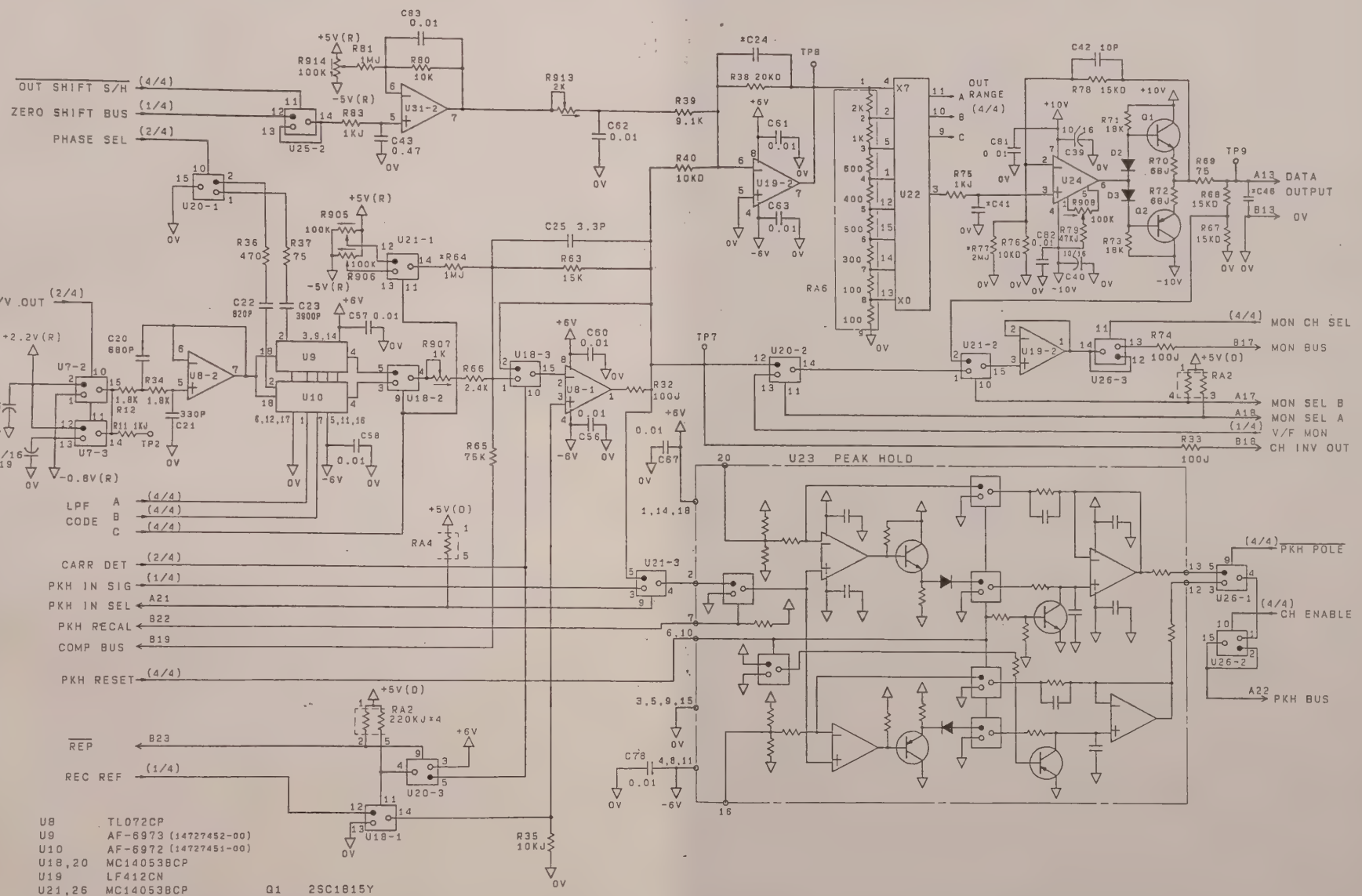
U4	15545024-00
U5	TL072CP
U6	MC14051BCP
U7	MC74HC4053
Z1	14723512-00
Z2	13494043-00

S.BAND				S.H.BAND				V/F.F/V				LPF FILTER			
SPEED CODE			SPEED	SPEED CODE			SPEED	F0 CODE			CAR.FO	LPF CODE			BW
C	B	A	cm/s	C	B	A	cm/s	C	B	A	kHz	C	B	A	kHz
				1	1	1	76	1	1	1	259.2	1	1	1	80
1	1	1	76	1	1	0	38	1	1	0	129.6	1	1	0	40
1	1	0	38	1	0	1	19	1	0	1	64.8	1	0	1	20
1	0	1	19	1	0	0	9.5	1	0	0	32.4	1	0	0	10
1	0	0	9.5	0	1	1	4.8	0	1	1	16.2	0	1	1	5
0	1	1	4.8	0	1	0	2.4	0	1	0	8.1	0	1	0	2.5
0	1	0	2.4	0	0	1	1.2	0	0	1	4.05	0	0	1	1.25
0	0	1	1.2	0	0	0	0.6	0	0	0	2.025	0	0	0	0.625

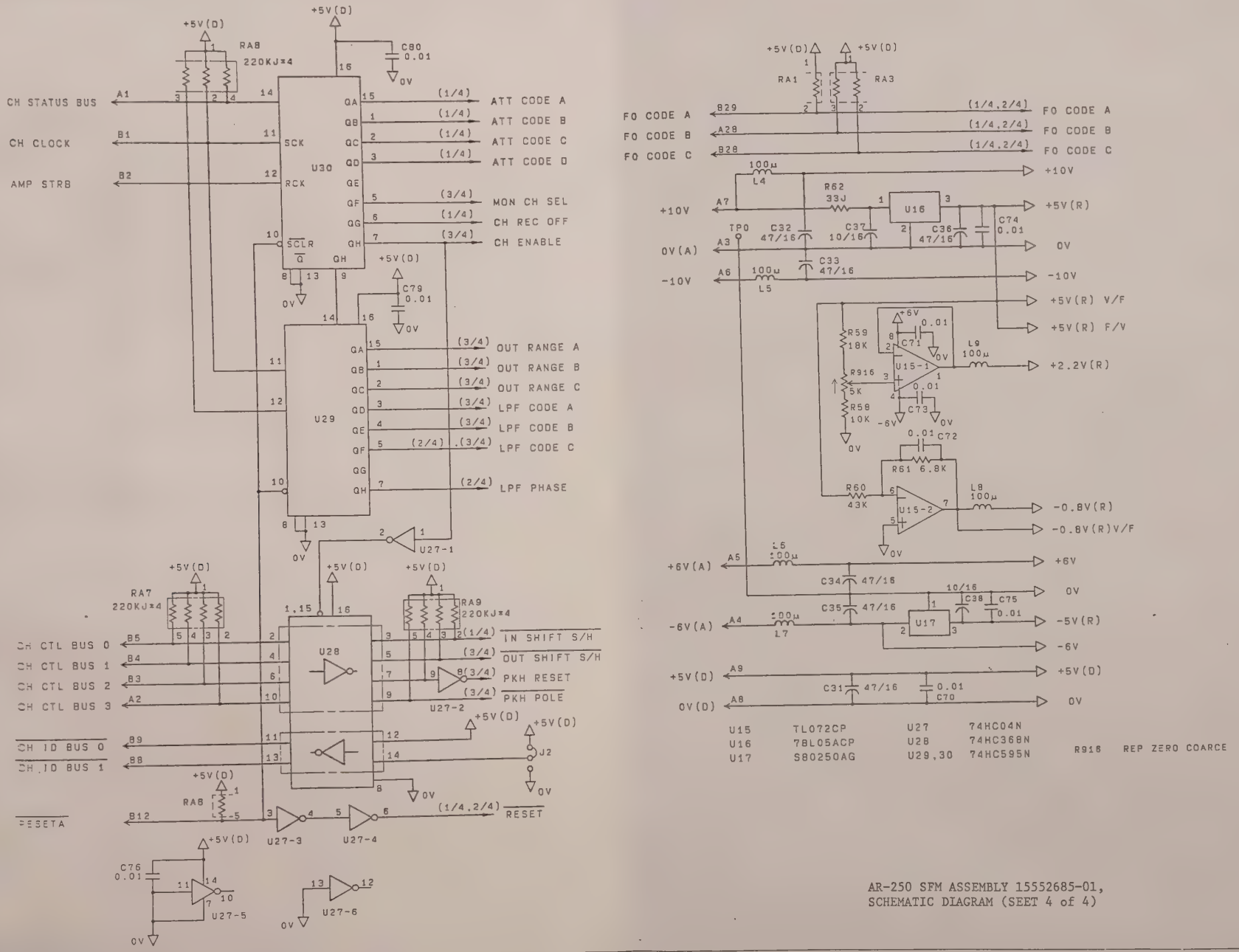
OUTPUT AMP			
OUT RANGE			RANGE
C	B	A	V
1	1	1	5
1	1	0	3
1	0	1	2
1	0	0	1.4
0	1	1	1.0
0	1	0	0.5
0	0	1	0.2
0	0	0	0.1

INPUT AMP				
ATT CODE				RANGE
D	C	B	A	V
1	1	1	1	20
1	1	1	0	14
1	1	0	1	10
1	1	0	0	7
1	0	1	1	5
1	0	1	0	3
1	0	0	1	2
0	1	1	0	1.4
0	1	0	1	1.0
0	1	0	0	0.7
0	0	1	1	0.5
0	0	1	0	0.3
0	0	0	1	0.2
0	0	0	0	0.1

AR-250 SFM ASSEMBLY 15552685-01,
SCHEMATIC DIAGRAM (SEET 2 of 4)



AR-250 SFM ASSEMBLY 15552685-01,
SCHEMATIC DIAGRAM (SEET 3 of 4)



AR-250 SFM ASSEMBLY 15552685-01,
SCHEMATIC DIAGRAM (SEET 4 of 4)

14. PARTS LIST

AR-250SFM PCBA PARTS LIST - 1

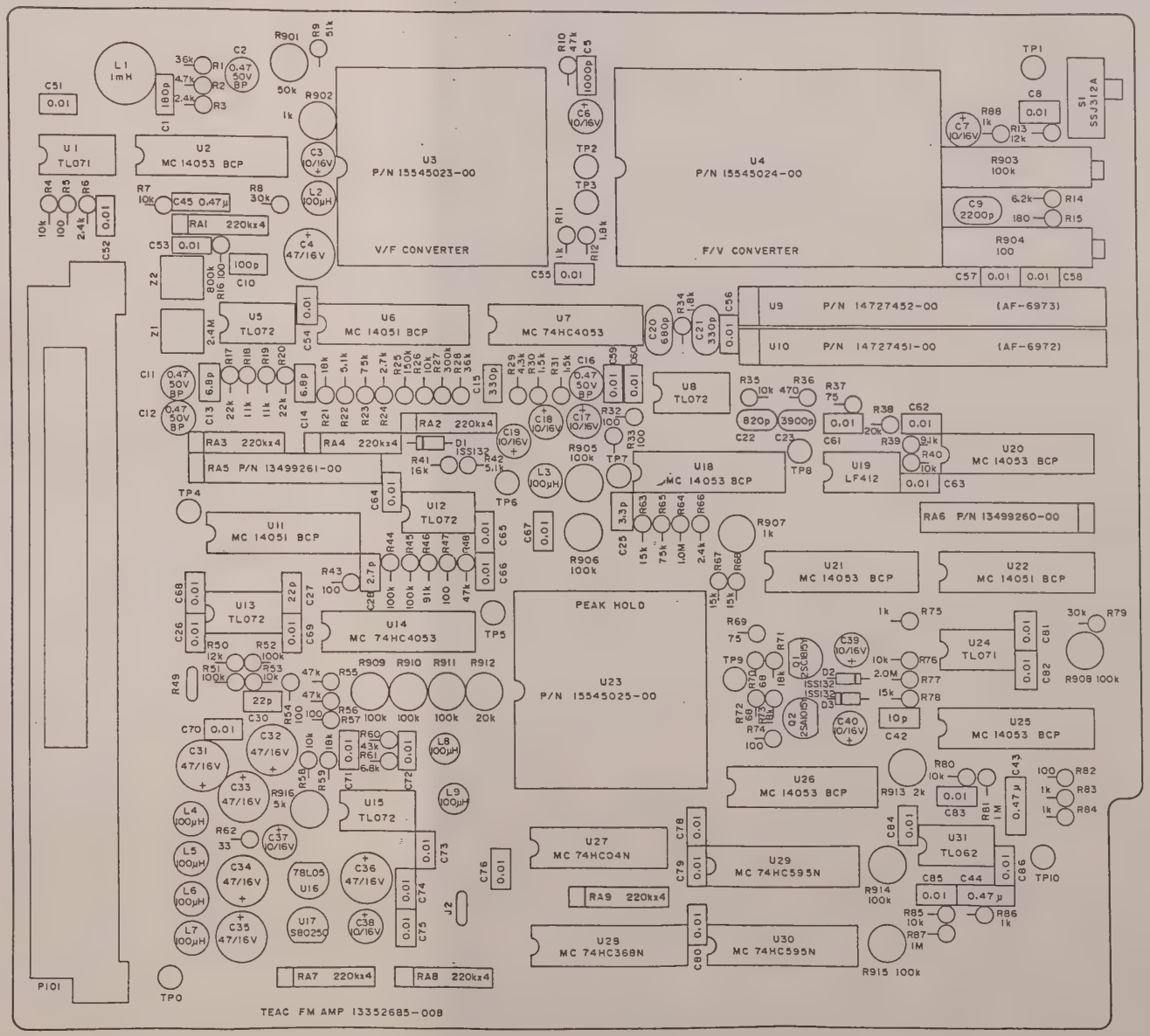
REF NO.	PARTS NO.	DESCRIPTION	Q'TY	REMARKS
	13352685-00	PCB, FM AMP	1	
	16787895-00	Card puller	1	
U23	15545025-00	PCBA PEAK HOLD	1	HIC
U3	15545023-00	PCBA V/F CONVERTER	1	HIC
U4	15545024-00	PCBA F/V CONVERTER	1	HIC
		-Coils-		
Z1	14723512-00	Bias trap 2.4MHz	1	
Z2	13494043-00	Bias trap 800KHz	1	
		-IC's-		
U1, 24	13447276	TL071P	2	
U15, 5, 8, 12, 13	13447278	TL072P	5	
U31	13447295	Linear, TL062CP	1	
U19	13447373	LF412CN	1	
U16	13447243	Linear, MC78L05ACP	1	
U17	13447689	Linear, S-80250AG	1	
U27	13442151	MC74HC04N	1	
U28	13442558	MC74HC368N	1	
U29, 30	13442867	MC74HC595N	2	
U7, 14	13443145	MC74HC4053N	2	
U6, 11, 22	13441441	MC14051BCP	3	
U2, 18, 20, 21, 25, 26	13441434	MC14053-BCP	6	
		-Diode-		
D1, 2, 3	13411383	Switching, 1SS132	3	
		-Transistors-		
Q2	13421123	2SA1015-Y	1	
Q1	13424193	2SC1815-Y	1	
		-Coils-		
L2, 3, 4, 5, 6,7, 8, 9	14723477	Choke, 100MH	8	
L1	14723513	Choke, 1mH 5%	1	FB-075
		-Connector-		
P101	13123334	64P (00 8272 264 001 122)	1	
		-Slide, switch-		
S1	13224207	SSJ312A	1	
		-Terminal, check-		
TP0 to 10	13189150	MK-1095	11	

AR-250SFM PCBA PARTS LIST - 2

REF NO.	PARTS NO.	DESCRIPTION	Q'TY	REMARKS
		-Variable resistors -		
R902, 907	13256875	1 k ohm	2	(RJ-4W)
R913	13256876	2 k ohm	1	(RJ-4W)
R916	13256877	5 k ohm	1	(RJ-4W)
R912	13256879	20k ohm	1	(RJ-4W)
R901	13256880	50k ohm	1	(RJ-4W)
R905, 906, 914, 915, R908 to 911	13256881	100k ohm	8	(RJ-4W)
R904	13257368	100 ohm	1	10%
R903	13257377	100 k ohm	1	10%
		- Array resistors-		
RA6	13499260-00	8-Element	1	
RA5	13499261-00	9-Element	1	
RA1 to 4, 7 to 9	13497774	4-Element 220 k ohm	7	5%
		- Resistors -		
R37, 69	11070750	RN 1/5W 75 ohm	2	1%
R15	11070181	RN 1/5W 180 ohm	1	1%
R36	11070471	RN 1/5W 470 ohm	1	1%
		- Filters -		
U10	14727451-00	Low pass AF-6972	1	HIC
U9	14727452-00	Low pass AF-6973	1	HIC
		- Resistors -		
R30, 31	11070152	RN 1/5W 1.5 k ohm	2	1%
R12, 34	11070182	RN 1/5W 1.8 k ohm	2	1%
R3, 6, 66	11070242	RN 1/5W 2.4 k ohm	3	1%
R24	11070272	RN 1/5W 2.7 k ohm	1	1%
R29	11070432	RN 1/5W 4.3 k ohm	1	1%
R22, 42	11070512	RN 1/5W 5.1 k ohm	2	1%
R14	11070622	RN 1/5W 6.2 k ohm	1	1%
R61	11070682	RN 1/5W 6.8 k ohm	1	1%
R39	11070912	RN 1/5W 9.1 k ohm	1	1%
R4, 7, 26,58	11070103	RN 1/5W 10 k ohm	4	1%
R18, 19	11070113	RN 1/5W 11 k ohm	2	1%
R13, 50	11070123	RN 1/5W 12 k ohm	2	1%
R63	11070153	RN 1/5W 15 k ohm	1	1%
R41	11070163	RN 1/5W 16 k ohm	1	1%
R21, 59, 71	11070183	RN 1/5W 18 k ohm	4	1%
73				1%
R17, 20	11070223	RN 1/5W 22 k ohm	2	1%
R28	11070363	RN 1/5W 36 k ohm	1	1%
60	11070433	RN 1/5W 43 k ohm	1	1%
R9	11070513	RN 1/5W ..51k ohm	1	1%
R23, 65	11070753	RN 1/5W 75 k ohm	2	1%

AR-250SFM PCBA PARTS LIST - 3

REF NO.	PARTS NO.	DESCRIPTION	Q'TY	REMARKS
		Resistors:		
R46	11070913	RN 1/5W 91 k ohm	1	1%
R44, 45	11070104	RN 1/5W 100 k ohm	2	1%
R25	11070154	RN 1/5W 150 k ohm	1	1%
R27	11070304	RN 1/5W 300 k ohm	1	1%
R40, 53, 76	11078103	RN 1/4W 10 k ohm	3	0.5%
R67, 68, 78	11078153	RN 1/4W 15 k ohm	3	0.5%
R38	11078203	RN 1/4W 20 k ohm	1	0.5%
R51, 52	11078104	RN 1/4W 100 k ohm	2	0.5%
R62	11190330	RD 1/5W 33 ohm	1	5%
R70, 72	11190680	RD 1/5W 68 ohm	1	5%
R33, 43, 47,5,	11190101	RD 1/5W 100 ohm	10	5%
16, 32, 82, 54,				5%
57, 74				
R11, 75, 83,	11190102	RD 1/5W 1.0k ohm	6	5%
84, 86,88				5%
R2	11190472	RD 1/5W 4.7 k ohm	1	5%
R35, 80, 85	11190103	RD 1/5W 10 k ohm	3	5%
R8, 79	11190303	RD 1/5W 30 k ohm	2	5%
R1	11190363	RD 1/5W 36 k ohm	1	5%
R10, 48, 55, 56	11190473	RD 1/5W 47 k ohm	4	5%
R64, 81, 87	11190105	RD 1/5W 1 M ohm	3	5%
R77	11190205	RD 1/5W 2M ohm	1	
		Capacitors:		
C28	12900457	CC 100V 2.7PF	1	
C25	12900458	CC 100V 3.3PF	1	
C13, 14	12900462	CC 100V 6.8PF	2	2%
C42	12900464	CC 100V 10 PF	1	
C27, 30	12900468	CC 100V 22PF	2	
C10	12900476	CC 100V 100PF	1	10%
C1	12901304	CC 100V 180PF	1	10%
C15	12901307	CC 100V 330PF	1	10%
C5	12901313	CC 100V 1000PF	1	
C51 to 76,	12901330	CC 63V 0.01MF	37	
C78 to 86,8,				
26				
C43, 44, 45	12388474	CC 50V 0.47MF	3	
C17, 18, 19,	12901900	CE 16V 10MF	10	20%
3, 6, 7, 37,38,				
39, 40				
C31 to 36, 4	12902015	CE 16V 47MF	7	20%
C16, 2, 11, 12	12904084	CE 50V 0.47MF BP	4	20%
C21	12454331	CQ 100V 330PF	1	2%
C20	12454681	CQ 100V 680PF	1	2%
C22	12454821	CQ 100V 820PF	1	2%
C9	12454222	CQ 100V 2200PF	1	2%
C23	12454392	CQ 100V 3900PF	1	2%


U1 TL071
U2 MC 14053 BCP
U3 P/N 15545023-00
V/F CONVERTER
U4 P/N 15545024-00
F/V CONVERTER
U5 TL072
U6 MC 14051 BCP
U7 MC 74HC4053
U8 TL072
U9 P/N 14727452-00 (AF-6973)
U10 P/N 14727451-00 (AF-6972)
U11 MC 14051 BCP
U12 TL072
U13 TL072
U14 MC 74HC4053
U15 TL072
U16 78L05
U17 S8025C
U18 MC 14053 BCP
U19 LF412
U20 MC 14053 BCP
U21 MC 14053 BCP
U22 MC 14051 BCP
U23 P/N 15545025-00
PEAK HOLD
U24 TL071
U25 MC 14053 BCP
U26 MC 14053 BCP
U27 MC 74HC04N
U28 MC 74HC368N
U29 MC 74HC595N
U30 MC 74HC595N
U31 TL062
RA1 220kx4
RA2 220kx4
RA3 220kx4
RA4 220kx4
RA5 P/N 13499261-00
RA6 P/N 13499260-00
RA7 220kx4
RA8 220kx4
RA9 220kx4
R901
R902
R903 100k
R904 100
R905 100k
R906 100k
R907 1k
R908 100k
R909 100k
R910 100k
R911 100k
R912 20k
R913 2k
R914 100k
R915 100k
TP0
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
P101
J2
S1 SSS312A
TEAC FM AMP 13352685-008

AR-250SFM

APPENDIX:

PARTS ORDERING INFORMATIONS

When ordering parts, always include the following information:

1. MODEL
2. UNIT SERIAL NO.
3. DESCRIPTION
4. REF. NO.

NOTICE REGARDING PARTS ORDERS

1. In some instances, indivisual minor parts are not available. In this case, the entire assembly, including the part requested, will be sent to you.
2. Do not order by only REF. No. or Description.
3. Parts marked with an * require longer delivery time, about two to three months.

NOTE:

–CAPACITORS–

CC = Ceramic, Magnetic capacitor.

CS = Tantalum.

CQ = Metallized film capacitor,
Film capacitor,
Metallized Polypropylene film.

CE = Aluminium electrolytic capacitor.

–RESISTORS–

RD = Carbon.

RN = Metal film.

VR = Variable resistor.

情報機器営業品目(Information Products)
- ●計測用データレコーダ (Data Recorders)
- ●計測用各種センサおよび直流増幅器 (Sensors & Amplifiers)
- ●コミュニケーションレコーダ (Communications Recorders)
- ●ビデオテープレコーダ (Video Tape Recorders)
- ●ビデオディスクレコーダ (Video Disk Recorders)
- ●FA機器
- ●パーソナルコンピュータ用サブシステム

周辺機器営業品目(Computer Peripheral Products)
- ●フロッピーディスクドライブ (Floppy Disk Drives)
- ●ハードディスクドライブ (Hard Disk Drives)
- ●ディジタル磁気テープ記憶装置 (Tape Streamers)

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